Lecture 14 - Exam Review

Tuesday, March 24, 2020   11:05 AM

Objectives:	- Introduce the on-line course details - Begin reviewing the exam questions

Exam 1B Spring 2020

ECE 344L Microprocessors
Test 1

100 Points MAX

Name:_____

21 Points

1. **Number Representation:** In the MIPS processor, we can represent numbers in either signed or unsigned format. Assuming that our word size is **7 bits**, fill the blanks in the table below using **both** binary values **and** their decimal equivalent.

Number	Unsigned		Signed	
Maximum value which can be represented	111 1111	127	011 1111	63
Minimum value which can be represented.	000 0000	0	100 0000	~64
21	001 0101	21	001 0101	21
-8	N/A		111 1000	-8

UNSIGNED
MAX = $2^7 - 1 = 127$

SIGNED
MAX = $2^{w-1} - 1$
MIN = -2^{w-1}

W = 7

WEIGHTS
±64 32 16 8 4 2 1

-64 +32 +16   +8
  1   1   1   1

RUN SUM   -16 -8

4 Points

2. Given the following binary value, 10101010010, what is the equivalent hexadecimal value?

5 5 2

_____0x1B5

_____0x16A

✓_____0x552

_____0x362

1.

3/10/20

3. What are the three basic operations in processing an instruction in a stored program computer? **6 Points**

$$\text{FETCH} - \text{DECODE} - \text{EXECUTE}$$

6 Points

4. Given a processor which is a CISC processor, select the characteristics below which apply:

_____Many general purpose registers

___✓___Many addressing modes

___✓___Few general purpose registers

_____Fixed length instructions

___✓___Instructions require one to many clock cycles to execute

RISC	CISC
1 INSTR/CLK CYCLE	1-MANY CLOCKS/INSTR
1 FEW ADDR MODES	MANY ADDR MODES
1 MANY G.P. REG	FEW G.P. REG
FIXED LENGTH INSTR	VARYING LENGTH INSTR

5. In the MIPS processor that is part of the PIC32 microcontroller, what is the length of each instruction? **4 Points**

_____ 16 bits

_____ 24 bits

___✓___ 32 bits

_____ 64 bits

6. In the MIPS processor, how many bits are used to represent a byte and how many are used to represent a half-word? **4 Points**

8 bits / BYTE

HALF-WORD -16 BITS - 2 BYTES

WORD 32- BITS - 4 BYTES

2.

7. In the PIC microcontroller, we use SFRs. What are SFRs used for and how do they differ from general purpose registers? **10 Points**

SFR's — CONFIGURE HW
CONFIGURE PERIPHERALS
MONITOR STATUS
COMMUNICATE w/ PERIPHERALS

GPR — DATA & ADDRESSES   NO INSTRUCTIONS

8. The MIPS processor has a load-store instruction set. Explain what is meant by load-store. **10 Points**

ONLY TWO INSTRUCTION TYPES THAT ACCESS MEMORY, LOAD & STORE
OPERAND MUST FIRST BE LOADED FROM MEM. TO A REG.
PROCESS DATA
STORE RESULT FROM REG BACK TO MEMORY

10 Points

Memory contents

9. If our MIPS code has the following instruction:

    lw $t1, 16($t0) where $t0 contains 0xB00C

address: 16 PLUS CONTENTS OF $t0

   a. Which value would be written into $t1?

address = 16 + 0xB00C =
         ___
         DEC
   0x10   0xB01C
        VALUE: 0x1BB7

   b. What instruction would you use to write the value in $t1 to memory address 0xB008?

Memory contents	Address
0XCD99	0xB000 — C
0xA100	0xB004 — 8
0x4888	0xB008 — 4
0x6541	0xB00C $t0→
0x722B	0xB010
0x4220	0xB014
0xCA0A	0xB018
0x1BB7	0xB01C ← LOCATION
0x2000	0xB020
0x78B0	0xB024

SW $t1, OFFSET ($t0)

SW $t1, −4($t0)

3.

3/10/20

10. The MIPS processor uses a pipeline architecture, which can result in data hazards and **10 Points** control hazards. What is a data hazard? Give a specific example of where we must deal with data hazards when writing assembly language programs for the MIPS processor.

10 Points

11. In the MIPS assembly language code shown for the MinMax routine, explain in detail what will happen if a nop instruction is not included after the following instruction, which appears on line 21:

bnez $a1, loop

1	.text	# Pipelined Implementation	
2	MinMax:		
3		lw	$v0, 0($a0)
4		addiu	$a0, $a0, 4
5		addi	$a1, $a1, -1
6		blez	$a1, ret
7		move	$v1, $v0
8	loop:		
9		lw	$t0, 0($a0)
10		addi	$a0, $a0, 4
11		bge	$t0, $v0, next
12		nop	
13		b	chk
14		move	$v0, $t0
15	next:		
16		ble	$t0, $v1, chk
17		nop	
18		move	$v1, $t0
19	chk:		
20		addi	$a1, $a1, -1
21		bnez	$a1, loop
22		nop	
23	ret:		
24		jr	$ra
25		nop	

4.

3/10/20

12. When we are configuring all of the bits in a ports as outputs, we must also configure   *5 Points*
     the open-drain setting for each of them.

     _____   TRUE

     _____   FALSE

13. You are using timer 1 to measure a specific time interval. With your configuration of   *5 Points*
     the clock source and the maximum pre-scaler option, you determine that you will
     need to count 57,322 clock pulses.   This is possible using timer 1. (Explain why, or why not.)

     _____   TRUE

     _____   FALSE

5 Points

14. Our microcontroller uses a system clock for controlling the processor operations (SYSCLK). We use a
     separate clock to drive the peripheral devices (PBCLK). Why do we use different clocks and how are
     they typically configured with respect to each other?

5.

3/10/20